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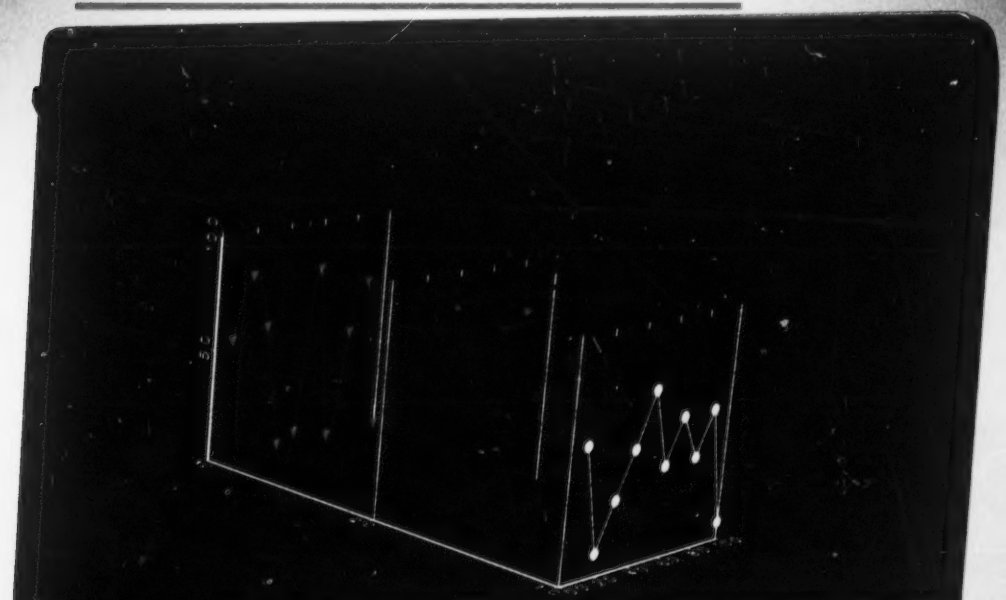
R&D

Research & Development



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The International Magazine of Research and Development

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Biotechnology Firms Face Obstacles From Trade and Regulatory Concerns

Biotechnology firms in the U.S., while currently the undisputed technical leaders of the almost 20-year-old industry, face critical bottlenecks which may hinder their future competitiveness, according to a recent U.S. Office of Technology Assessment (OTA) report.

Despite being industry leaders, most U.S. biotech firms still have no sales and have been losing money since their inception. Only about 20% of U.S. biotech firms were profitable in 1990, while most are still several years away from a positive cash flow position.

One reason for the lack of profitability is the capital-intensive nature of product development: prior to product commercialization, some companies dedicate nearly 65% of all expenses to R&D. As much as $5 billion to $10 billion may be needed to develop the 100 biotech products currently in human clinical trials, according to the OTA study. However, many leading firms have high liquidity and can generate cash once product revenues start to flow.

Competitiveness issues facing U.S. companies include fair-trade practices, protection of intellectual property, the regulatory climate, and tax policies. To date, the U.S. R&D tax credit has been of little use to most firms because they are not profitable enough to generate a credit.

Many new biotech firms will face mergers and acquisitions as they try to find sources of working capital. While the OTA study found insufficient evidence for concern about foreign acquisitions, it recognized that the high cost of capital in the U.S. may put U.S. firms at a disadvantage in the long term.

FDA approval of biotech products was one item noted as being "inadequate to provide expeditious approval of important new drugs." Since the report was issued, however, the White House Competitiveness Council announced major streamlining changes in the FDA's drug approval process.

Despite all these problems, the OTA study still maintains that biotechnology is likely to be the principal scientific driving force for the discovery of new drugs and therapeutic chemicals in the 21st century.

—Tim Studt

***Biotech firms focus** on pharmaceuticals because more capital is available for them than for food or agriculture, due to the prospect of greater markets.*

Technical, Business Success Go Together

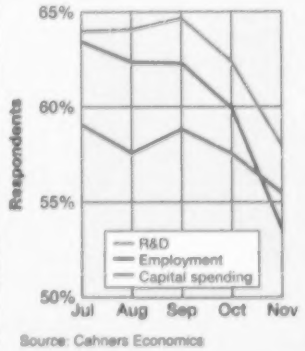
Technology leads business success when companies know how to manage technical resources, find commercial applications, and execute product, process, and quality improvements sooner than their competitors, according to William Howard, Jr., a senior fellow at the National Academy of Engineering (NAE), Washington.

Howard was chairman of the NAE committee responsible for "Profiting From Innovation," a recently published report. Here the committee discusses the organizational and management challenges that appear in commercializing new products. These challenges include managing joint technical programs, integrating technical efforts, nurturing product cham-

Strong Growth for Elemental Analyzers

The market for elemental analyzers is forecast to grow 8.5% annually through 1995 to $230 million, according to Strategic Directions International Inc., a Los Angeles-based consulting firm.

The environmental segment of the elemental analyzer market is growing more than 11% annually, while the metals and other segments are growing at a slower pace of less than 7% per year.



R&D Slide Continues

Corporate executives continued to lose confidence in their ability to maintain R&D efforts, according to a survey by Cahners Economics, Newton, MA.

Only 57.9% of the 400 companies interviewed in CE's November survey said their R&D would remain stable or increase over the next few months. Employment and capital spending had similiar declines.

tioning, polystyrene and polyethylene insulating foams, and other applications.

Changes are also taking place in the electronics industry, where for decades CFCs were used as cleaning solvents because of their stability and compatibility with most materials. But stability is also a main problem of CFCs: They are so stable they cannot be easily extracted from the atmosphere.

No-Clean fluxes from Alpha Metals Inc., Jersey City, NJ, eliminate the need for excessive rinsing of printed circuit boards and resulting wastewater treatment, the company says. The No-Clean technique leaves almost no residue on boards.

One of the company's fluxes is halide-free and rosin/resin-free with a 2.1% solids content. Other Alpha Metals fluxes have 2.2% and 4.4% solids levels.

"Our challenge was to find organic materials that remove copper, lead, and other metal oxides from circuit boards and component surfaces," says Alpha Metal's John Stevenson, product manager of assembly chemicals. "Two to three years ago, traditional fluxes contained 30% to 40% solids. Today we rely on organic acids and materials that volatilize at soldering temperatures to reduce solids content This process has resulted in totally gaseous products that leave virtually zero residue."

Too much residue can result in ionic contaminants that lower surface insulation resistance of the boards. The small amount of residue left on the No-Clean boards also eliminates problems during automatic pin testing procedures. Extensive residue can form insulating pads on boards, and during testing, the system might detect defects where there are none.

Another company, Zenon Environmental of Burlington, Ontario, is testing a membrane-based vapor permeation CFC recovery process that concentrates CFCs in liquid form. The process, developed primarily for refrigeration, pharmaceuticals, ink, and specialty chemicals, was created to minimize the damaging effects of organic vapors produced by industrial processes that involve volatile hydrocarbons. Released into the atmosphere, such vapors and contaminants help create photochemical smog.

—Joyce Anne Oliver

Invention Offers a Different Angle on Tilt Control

Inventor Michael Summerfield demonstrates his Tilt Coupling, a leveling device that won two technology awards in Britain. Unlike other devices, the coupling can be set to a specific angle of tilt in less than 10 sec and has just one control for adjustment and locking.

The coupling uses two flat rings coupled by a hollow universal joint, with a pair of toothed wedge-shaped cams and a slip ring between them.

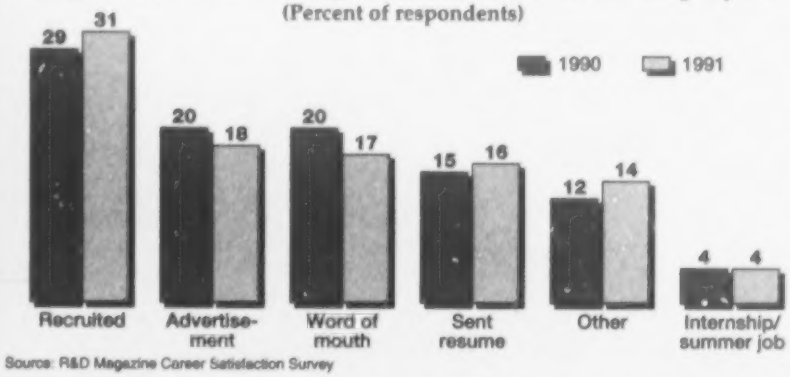
The rings are able to tilt to an angle of 20 deg relative to each other in all directions, but they are retained in rotationally the same position.

The device has applications in control mirrors and laser lens systems, telescope mounts, satellite dishes, x-ray tables, surveying, and filming.

More information: Circle 360 on the Reader Service Card.

How Scientists and Engineers Found Current Employers

(Percent of respondents)



Source: R&D Magazine Career Satisfaction Survey

The means by which researchers found jobs were fairly consistent among respondents to R&D Magazine's 1990 and 1991 Career Satisfaction Surveys. A complete analysis of results from the 1991 survey will appear in a future issue.

New Mobile Phones Use Infrared Light, Avoid the Airwaves

Cellular systems have had a revolutionary impact on the telephone industry, but telecommunications companies continue to search for more effective concepts.

The most innovative approach might come from infrared technology. A wireless pocket phone, invented by Light Ideas, Encino, CA, and recently demonstrated by British Columbia Telephone (an affiliate of GTE), offers what some experts call "crystal clear" transmission with greater privacy than cellular equipment.

"Many new concepts have been reported in recent years for wireless ac-

How Much Will It Cost To Run Your Lab in '92?

Global competition is forcing R&D managers to increase their budgets during the tough times of a double-dip recession.

*By **Tim Studt**, Senior Editor,* R&D Magazine

Recessions are like in-laws: They always arrive before you are ready for them, and they always hang around longer than you thought they would.

Most economists had predicted the U.S. economy would be in a recovery by now. The delay has put many R&D managers in a dilemma because of the need to stay profitable while developing new products.

The lingering recession also throws a curve at R&D budget planners, who no longer are quite sure how well their budget and cost predictions will hold up in this year's declining economy.

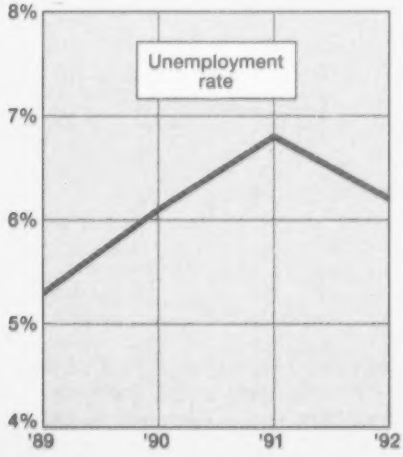
Despite this economic shakiness, managers of industrial, government, university, and nonprofit research centers are still optimistic about their spending plans for 1992, according to a recent survey of research managers by *R&D Magazine*. More than 80% of the survey respondents indicated that they would maintain or increase their R&D spending in 1992. Only 16.5% of the R&D managers queried said that they would decrease their research spending this year (see accompanying chart).

Most research managers are confident that a recovery will still occur in 1992. They feel they have to maintain their present research efforts to ensure continued competitiveness in a global economy.

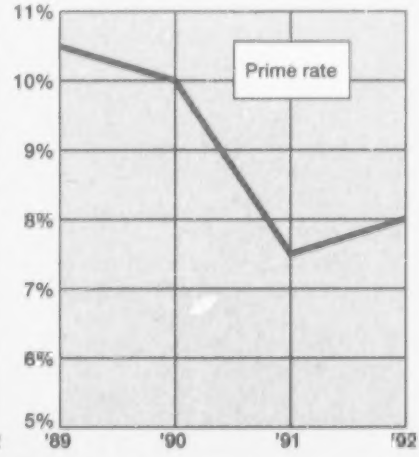
Additionally, with interest rates the lowest they've been in the past 10 years, the financing of research is as inexpensive as it is going to get. Current forecasts for interest rates indicate they will increase by the end of 1992 (see accompanying charts).

The lower U.S. financing costs now

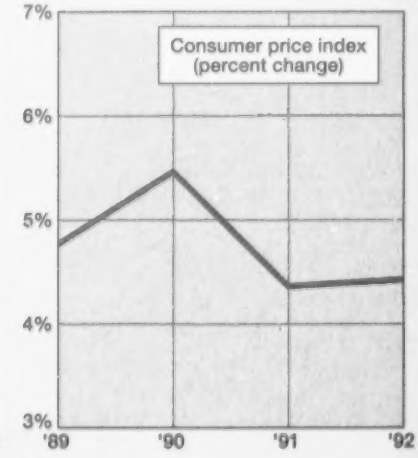
Deepening Recession Affects Economic Growth



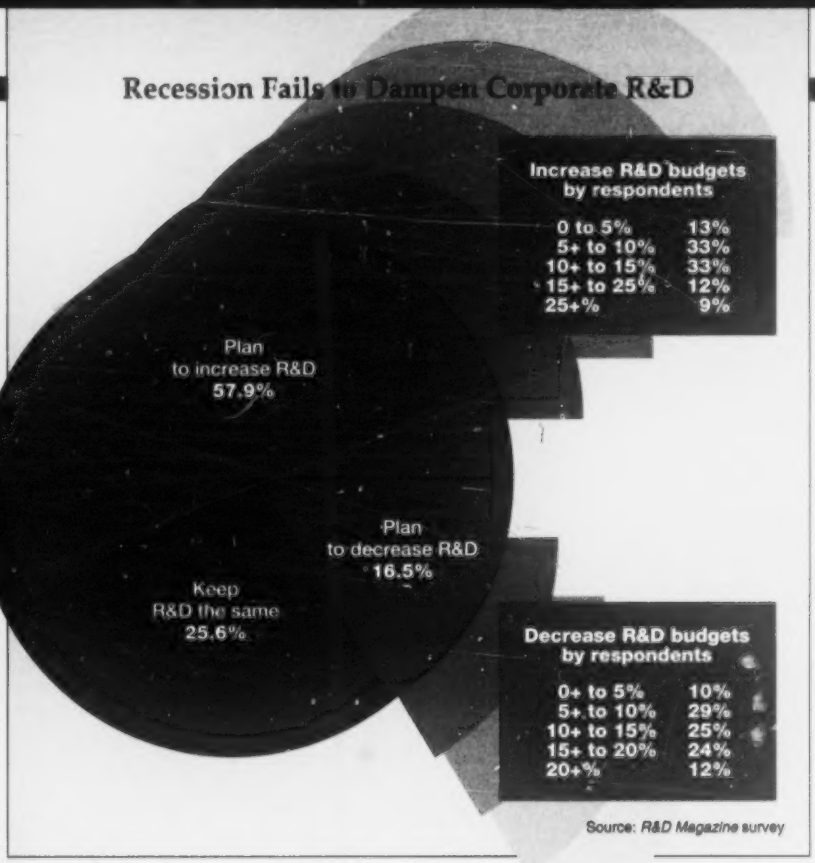
***The recession increased** U.S. unemployment through the end of 1991, but CE forecasts improvement in 1992.*



***Steady drops in** the prime rate over the past three years should make capital more available to U.S. firms.*



***CE does not forecast** any major changes over the next several years in the current level of the Consumer Price Index.*


Recession Fails to Dampen Corporate R&D
Increase R&D budgets by respondents
0 to 5% 13%
5+ to 10% 33%
10+ to 15% 33%
15+ to 25% 12%
25+% 9%
Plan to increase R&D 57.9%
Plan to decrease R&D 16.5%
Keep R&D the same 25.6%
Decrease R&D budgets by respondents
0+ to 5% 10%
5+ to 10% 29%
10+ to 15% 25%
15+ to 20% 24%
20+% 12%
Source: R&D Magazine survey

***More than** 80% of the R&D managers in a recent* R&D **Magazine** *survey said they will increase or maintain the current level of their R&D budgets in 1992.*

approach and sometimes beat those of foreign firms, such as those in Japan. U.S. companies can now afford to invest more in equipment and wait longer for a payback on capital projects. U.S. firms were handicapped during the 1980s with financing costs that were twice those of companies in Japan and Germany.

The size of the research budget increases indicated in the *R&D Magazine* survey also was encouraging, considering the state of the economy. On average, research managers said they would increase their 1992 budgets by more than 13% over their 1991 budgets. Nearly 9% of the respondents indicated that they would increase their budgets by more than 25%.

When asked what were the limiting factors to even larger research spending increases, the managers almost universally responded that they were experiencing slow sales and narrow profit margins.

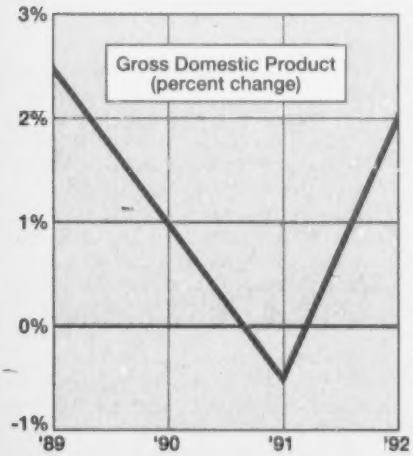
"Our budget is financed via profits; therefore, profit is a limiting factor on budget growth," says one industrial research manager.

"We're in a new product introduction cycle, so current development costs are impacting sales and subsequent profits," says another. "This will change in 1992 when our new products are introduced and revenues increase, thus financing our R&D increase."

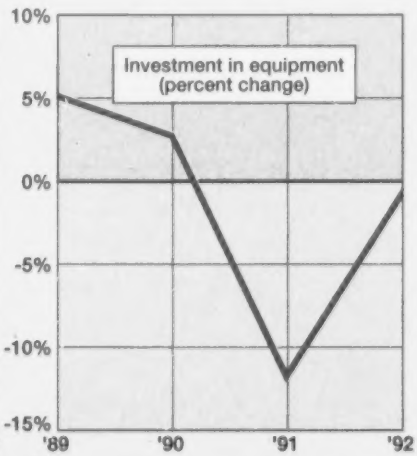
Governmental deficits are another limiting factor for Federal and state researchers. "The miserable state financial situation is a serious limiting factor on our research efforts," writes a New York state researcher.

Despite these limitations, there is a general confidence in future research spending that cuts across all sections of the U.S. and all sizes of companies, according to the survey results. Average budget increase predictions range from 10.2% for research organizations in the western U.S. to 15.9% for southern U.S. centers.

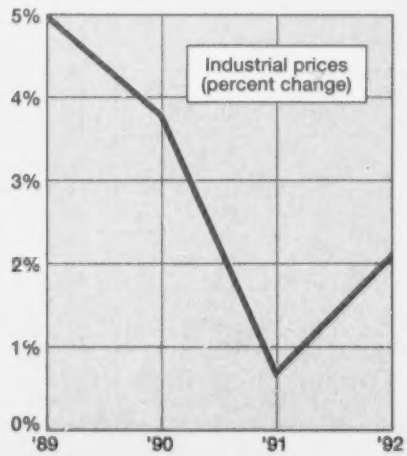
Similarly, respondents from organizations with less than 50 employees said their budgets would increase an average of 18.1% (the highest average increase), while organizations with 500 to 1,000 employees predicted in-



***GDP statistics** have replaced those of GNP, because they more accurately reflect the domestic U.S. economy.*



***The recession caused** capital investment to drop off in 1991 with little improvement forecast for 1992 by CE economists.*



***Industrial prices** only will see moderate increases in 1992, according to a forecast by the Laboratory Products Assn.*

Source: Cahners Economics Laboratory Products Assn.

'Costs for installing equipment in new research laboratories will see large increases in 1992,' says one supplier.

creases of 8% (the lowest average increase).

A section of *R&D Magazine's* research funding survey also inquired about the makeup of R&D budgets. Salaries make up the largest portion of R&D spending in 1992, according to the survey, consuming an average of 47.3% of an organization's budget. Overhead, which includes facilities and support services, makes up the next largest amount with a 19.3% portion. Capital equipment (12.3%), supplies and consumables (11.5%), and miscellaneous items (9.6%) fill out the remainder of the research budget.

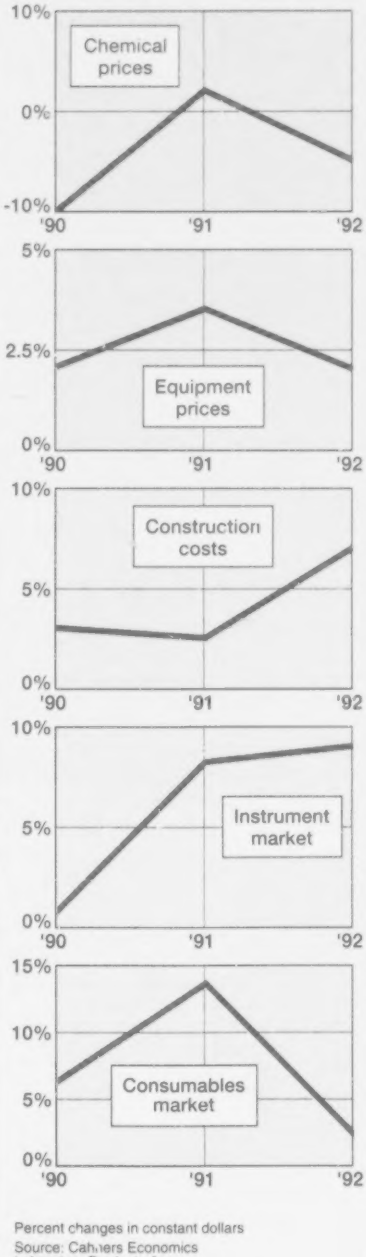
What will happen to the costs of these research budget components in 1992 and how will they affect the net level of research? For these answers, we contacted research managers and laboratory suppliers who responded with a list of both increases and decreases across the different sectors (see accompanying charts).

"R&D costs are governed by the same conditions that drive the rest of the economy, such as those that determine the cost of living," says James Serum, R&D manager for Hewlett-Packard analytical product group, Avondale, PA. "The primary governing effect on R&D is increases in the costs for salaries, supplies, and capital."

R&D Magazine's latest salary survey reveals that researchers' salaries increased in 1991 at a slightly higher rate than inflation, but increased benefits costs held back take-home increases. The current recession and continued pressure from global competitors to maintain lean staffing levels will keep the lid on salary demands in 1992.

The guiding trend for salary increases is the inflation rate, which in 1991 was about 4.3%. It is forecast to be 4.4% in 1992, according to Kermit Baker, chief economist at Cahners Economics, Newton, MA.

One area where research costs are forecast to experience substantial price increases is that of new laboratory construction. "There is a large amount of current renovation and new construction of research laboratories," says a product manager at a laboratory casework supplier. "While equipment costs, such as fume hoods and cabinets, will follow standard inflationary increases of the raw materials to make them, installation cost increases are forecast to far outpace the inflation rate."



***The prices for many** products used in the labortory will drop in 1992 while the cost of actually building a laboratory will increase, following several years of strong demand for mainly biotech labs.*

The heavy investment in R&D demanded by pharmaceutical and biotech companies is driving the demand for this new laboratory construction. The long-term research requirements of new products for these industries will keep demands and costs high for several years, according to the laboratory casework supplier.

Trying to estimate a general cost increase for laboratory instruments is meaningless because the performance improvements in new equipment and equipment upgrades trivialize comparisons. Instrument suppliers that were interviewed stated that in situations where totally identical instruments are involved, price increases will not exceed the inflation rate. But those cases represent a very small portion of their overall business.

"There is not a lot of emphasis on increasing prices of existing equipment in a down economy," says Michael Duff, vice president of public affairs at the Scientific Apparatus Makers Assn., Alexandria, VA. "Every three years there is a new generation of new products and system upgrades that changes the complexion of the market."

In other instrument-related areas, such as vacuum apparatus, price increases are a little easier to forecast because the product does not undergo periodical changes. Price increases in vacuum equipment are generally forecast to remain at their present levels throughout 1992.

"There was a major price increase in the cost of stainless steel in 1990," says one supplier of vacuum products. "But the recession and market pressure will keep prices stable in 1992."

On the other hand, chemicals used in the lab may cost you less in 1992. With low energy costs and few supply pressures foreseen, chemical prices in 1992 will moderate from the abnormally high prices seen in 1991, according to Julie Handelman, an economist at Cahners Economics. "The Gulf Crisis forced a dramatic price rise in industrial chemicals early in 1991," says Handelman. "However, prices started to plunge during last summer and are expected to end 1992 4.7% lower than in 1991."

The slow recovery from the current "moderate" recession has damped what might have been aggressive re-

'Research spending for biotechnology is likely to increase 9% in 1992, adding to 1991's 7% increase,' says Copeland.

search growth in some industrial areas. However, industrial research growth in the high-tech electronics, biotech, and computer areas will be the drivers in overall research growth (see accompanying box).

Biotech research is being driven by increased Federal funding, recently announced speedups in the FDA regulatory process, and recent diagnostic advances. "Research spending for biotechnology is likely to increase 9% in 1992, adding to the 7% increase seen in 1991," says William Copeland, president of Copeland Economics Group, Stamford, CT. As biotech companies turn to the production of FDA approved products, increased revenues will allow research increases of 11.7% in 1993, he says.

Growth in research spending in the computer industry is being severely hampered by a decline in sales. "In 1991, U.S. factory shipments of computers and office equipment declined 2.6%, the first negative year since 1986, says economist Handelman. "This industry will not exhibit any sustained recovery until mid-1992."

Costs for restructuring and downsizing will cut into the bottom line of computer makers, with only 7.2% sales growth forecast for 1992. IBM, for example, recently announced its intent to eliminate another 20,000 jobs, which brings to 55,000 the number of positions it has cut in the past two years. Research spending for computer equipment is forecast to increase 6.5% in 1992, according to a study performed by Schonfeld Associates, Lincolnshire, IL. IBM is still forecast to increase its research spending by 8.5% in 1992, although part of that will involve research with strategic partners.

R&D spending increases forecast by Schonfeld include:

- 8.8% in the aerospace industry fueled by both commercial and continued defense contracts;
- 8.9% in the chemical industry;
- 7.3% for semiconductor manufacturers;
- 6.4% for plastics manufacturers;
- 14% in the pharmaceutical industry;
- 9% for communications equipment companies.

A potential loser in the current economic recession is university research. "Education is hard hit by state budget cuts and a lower level of funding overall," says a Laboratory Products Assn. study performed by Coalesce Corp., Monte Sereno, CA. "Grants are more competitive and their purposes are more directly controlled, eliminating some research areas that formerly received federal funds."

With the deficit budgets of Federal, state, and city governments, a recovery of university research support is not expected for several years, according to the study. The obvious effect of diminishing governmental support for university research is increased costs for corporate contracts to cover the fixed laboratory and researcher expenses.

Most economists still agree that a slow recovery will occur by the third quarter of 1992, especially in an election year. Costs of running your research lab will probably not exceed the inflation rate and may, in many cases, decrease. Despite the fact that corporate profits are down substantially, it's not as bleak a picture for R&D laboratories as it is for most other corporate and governmental departments. **R&D**

Total U.S. R&D Growth Slows in 1992

Source: U.S. National Science Foundation, *R&D Magazine*

Total U.S. expenditures on research and development are expected to reach more than $156 billion in 1992, a 3% increase from the 1991 level stated by the U.S. National Science Foundation. After adjusting for 1992's predicted inflation rate of 4.4%, this figure represents nearly a 1.5% decrease in real R&D spending.

This decline marks the third consecutive year that R&D spending has dropped in real terms. Some of this can be attributed to a decrease in defense-related government research. While defense research, development, test, and evaluation declined 7% in 1991, these will increase a little over 1% in actual dollars in 1992, according to U.S. Dept. of Defense forecasts. Substantial decreases in defense-related research won't start to show up until 1993.

Only university and nonprofit research are forecast to experience real-dollar research spending increases in 1992, with a 7.3% increase in sourcing of research and with a 4.7% increase in actual research performed.

The federal deficit does not appear to be limiting the size of research expenditures at other government agencies. This may not hold true for long, since the deficit is forecast to increase from 1991's $250+ billion level to more than $350 billion in 1992, before decreasing back to $250 billion in 1993, according to Congressional Budget Office estimates.

The Dept. of Energy is forecast to increase its spending by 13% to $6.2 billion. The National Institute of Health will up their budget 7% to $8.9 billion in 1992, while the National Science Foundation will see an 18% increase to $2.6 billion.

Most government-funded research is performed externally, especially that for DOD, NSF, and NIH. About 60% of NIH research is performed in universities.

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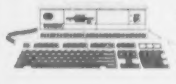

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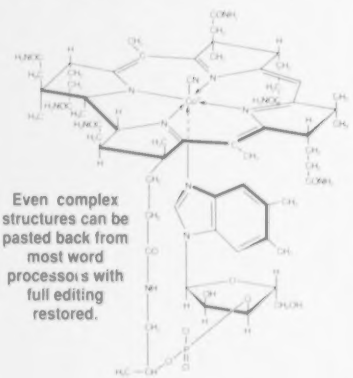

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